PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Monitor Fine Sediment And Sedimentation In John Day And Grande Ronde Rivers

BPA project number: 9703400
Contract renewal date (mm/yyyy): 7/1999 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Columbia River Inter-Tribal Fish Commission

Business acronym (if appropriate) CRITFC

Proposal contact person or principal investigator:

Name	Jon Rhodes, Hydrologist
Mailing Address	729 NE Oregon, Suite 200
City, ST Zip	Portland, OR 97232
Phone	(503)-731-1307
Fax	(503)-235-4228
Email address	rhoj@critfc.org

NPPC Program Measure Number(s) which this project addresses
3.3D.1, 7.6C.2, 7.6D

FWS/NMFS Biological Opinion Number(s) which this project addresses
NMFS Biological Opinion for the Wallowa-Whitman Timber Sales (NMFS, 1993); NMFS Biological Opinion for LRMPs for the Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests (NMFS, 1995)

Other planning document references
Wallowa-Whitman National Forest Plan (WWNF, 1990); NMFS Biological Opinion for the Wallowa-Whitman Timber Sales (NMFS, 1993); Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan (Anderson et al., 1992); NMFS Biological Opinion for LRMPs for the Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests (NMFS, 1995); Wy-Kan-Ush-Mi Wa-Kish-Wit (CRITFC, 1995). The CRITFC and the Confederated Tribes of the Umatilla Indian Reservation have repeatedly endorsed the habitat monitoring measures in Anderson et al. (1992) in a wide variety of official materials and correspondence, including the CTUIR Columbia Basin Salmon Policy (CTUIR, 1995) and (CRITFC,1995).

Short description
Monitor surface fine sediment and and overwinter sedimentation in cleaned gravel in spawning habits in the Grande Ronde and North Fork John Day rivers, analyze potential trends, investigate potential relationships in data, and relate to salmon survival.

Target species
Spring chinook salmon

Section 2. Sorting and evaluation

Subbasin
John Day, Grande Ronde

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☐ Multi-year (milestone-based evaluation) ☒ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☐ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
0	n/a	There are no other projects that depend on this project being funded. However, continued monitoring under this project is critical for analyzing project results from previous years for temporal trends.

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1998	We were notified that submission of an aritcle summarizing results of previous unfunded work similar to the project was accepted for publication in a peer-reviewed proceedings.	n/a
1998	Biological assessment completed and consultation with NMFS concluded with letter concurring that the project was unlikely to adversely affect spring/summer chinook or their	n/a

	habitat.	
1998	Surface fine data collected in four reaches in Grande Ronde and John Day Rivers and containers of cleaned gravels emplaced in streambed excavated to mimic salmon redds, prior to the onset of salmon spawning.	n/a
1998	Mid-winter collection of previously emplaced containers of gravels for particle size analysis and determination of level of mid-winter sedimentation of fine sediments.	n/a

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine if substrate goals of CRITFC (1995) and NMFS (1995) (<20% surface fines in spawning habitat) are met in monitored reaches.	a	Measure surface fine sediment in monitored reaches in John Day and Grande Ronde Rivers
2	Estimate if substrate goals of NPPC FW Program (<20% fine sediment in salmon redds) are met.	a	Prior to spawning, emplace containers of cleaned gravels in areas excavated to mimic redds. Collect containers after incubation for particle size analysis to determine amount of sedimentation of fine sediment as an index of conditions in redds.
3	Estimate effects of fine sediment on salmon survival from egg-to-emergence.	a	Analyze results of tasks in Objectives 1 and 2 using available methods relating fine sediment to salmon survival, e.g. Stowell et al. (1983); data of Scully and Petrosky (1991)
4	Investigate potential temporal interannual trends in surface fine sediment and overwinter sedimentation levels in monitored reaches.	a	Statistical analysis of results of multi-year measurements of surface fine sediment and overwinter sedimentation.
5	Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels.	a	Statistical analysis of results of multi-year measurements of surface fine sediment and overwinter sedimentation.
6	Determine if spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation within years and over time.	a	Statistical analysis of results of annual and multi-year measurements of surface fine sediment and overwinter sedimentation among reaches.
7	Report and disseminate findings.	a	Prepare and distribute annual and final reports, report results to StreamNet, present findings to watershed councils and fish and land management agencies, and submit an article summarizing results to a peer-reviewed publication.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	8/2000	9/2000	Measurements of surface fine sediment levels in spawning habitat in John Day and Grande Ronde Rivers and determine compliance with NMFS (1995) and CRITFC (1995) substrate goals.	Measurements of surface fine sediment levels in spawning habitat in John Day and Grande Ronde Rivers.	10.00%
2	8/2000	6/2001	Measure overwinter sedimentation in cleaned gravels in spawning habitat to provide an indication of amount of fine sediment in redds during incubation period to determine compliance with NPPC FW program goals for substrate.	Collection of containers of cleaned gravels; particle size analysis of contents of containers.	20.00%
3	5/2001	7/2001	Estimate salmon survival from egg-to-emergence in monitored reaches.	Particle size analysis of container contents, estimates of salmon survival based on fine sediment levels via available methods relating salmon survival to fine sediment levels.	10.00%
4	5/2001	7/2001	Investigate potential temporal interannual trends in surface fine sediment and overwinter sedimentation levels in monitored reaches.	Statistical trend analysis of results of multi-year measurements of surface fine sediment and overwinter sedimentation.	12.00%
5	5/2001	7/2001	Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels.	Statistical analysis of results of multi-year measurements of surface fine sediment and overwinter sedimentation.	13.00%
6	5/2001	7/2001	Determine if spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation within years and over time.	Statistical analysis of potential differences in temporal trends in surface fine sediment and overwinter sedimentation levels	10.00%
7	6/2001	9/2001	Report and disseminate findings.	Annual report detailing results to date; annual data	25.00%

				submitted to StreamNet; results disseminated to watershed councils and land and fish management entities.	
				Total	100.00%

Schedule constraints
High flows or late snowfall may cause seasonal delays in sample retrievals at some sites. If project is not funded by 8/2000, emplacement of cleaned gravel samples prior to spawning will not occur, precluding measurement of overwinter sedimentation.

Completion date
2004

Section 5. Budget

FY99 project budget (BPA obligated): $30,000

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel	Project leader for 3 mo. @ $4,121/mo; Technician for 1 mo. @ $2500/mo	%46	14,863
Fringe benefits	31.5% of salaries	%15	4,682
Supplies, materials, non-expendable property	Field forms, sample markers and containers, film	%0	66
Operations & maintenance	postage, photocopying, film processing	%1	380
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	none	%0	0
NEPA costs	none	%0	0
Construction-related support		%0	0
PIT tags	# of tags: 0	%0	0
Travel	vehicle rental, per diem, lodging, fuel	%4	1,144
Indirect costs	37.9% of personnel, supplies, operations and maintenance and travel	%25	8,010
Subcontractor	M.D. Purser, Hydrologist	%9	3,000
Other		%0	
TOTAL BPA FY2000 BUDGET REQUEST			$32,145

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
BPA	Total Project	%50	32,145
		%0	
		%0	

		%0	
Total project cost (including BPA portion)			$64,290

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$33,070	$34,720	$36,455	

Section 6. References

Watershed?	Reference
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☐	Everest, F.H.and five others. 1987. Fine sediment and salmonid production: a paradox. Streamside Management: Forestry and Fishery Interactions, pp. 98-142, Univ. of Wash. Inst. of Forest Resources, Contribution No. 57, Seattle, Wa.
☐	Grost, R.T., W.A. Hubert, and T.A. Wesche. 1991. Description of brown trout redds in a mountain stream. Trans. Amer. Fish. Soc., 120: 582-588.
☒	Huntington, C.W., 1993. Stream and Riparian Conditions in the Grande Ronde Basin. Clearwater BioStudies, Inc., Canby, OR.
☐	King, J.G. and R.F. Thurow. 1991. Progress Report: Sediment Monitoring Techniques Validation. USFS Intermountain Research Station, Boise, Id., unpublished.
☐	King, J.G., R.F. Thurow and J.L. Clayton. 1992. Progress Report: Sediment Monitoring Techniques Validation. USFS Intermountain Research Station, Boise, Id., unpublished

☐	Kondolf, G.M., 1997. Application of the pebble count: Notes on purpose, method, and variants. J. Am. Water Resour. Assoc., 33: 79-87.
☐	Leopold, L.B., 1992. Sediment size that determines channel morphology. Dynamics of Gravel Bed Rivers, J. Wiley, New York.
☐	Lisle, T., 1989. Sediment transport, and resulting deposition in spawning gravels channels, north coastal California. Water Resour. Res., 25: 1303-1319.
☐	Lisle, T., and R.E. Eads, 1991. Methods to measure sedimentation of spawning gravels. USFS Pacific Southwest Res. Station Res. Note PSW-411, USFS, Arcata, CA.
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☒	OWRD, 1986. Water Resources Basin Report for the John Day River Basin, OR. OWRD, Salem, OR.
☐	Platts, W.S. and 12 others, 1987. Methods for Evaluating Riparian Habitats with Applications to Management. USFS Gen. Tech. Report INT-221, Ogden, Utah.
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☐	Wolman, M.G., 1954. A method of sampling coarse river-bed material. Trans. Am. Geophys. Union, 35: 951-956.
☐	

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PART II - NARRATIVE

Section 7. Abstract

For five years, the proposed project will annually measure surface fine sediment and overwinter sedimentation of fine sediment in salmon spawning habitat during the incubation period in portions of the Grande Ronde and John Day Rivers in sites constructed to mimic salmon redds. Objectives are to: a) determine temporal trends in surface fine sediment and relation to substrate goals of CRITFC (1995) and NMFS (1995); b) determine magnitude and temporal trends in overwinter sedimentation and relationship to NPPC (1994) substrate goals; c) estimate effect of overwinter sedimentation on salmon survival using existing information; d) investigate relationship between overwinter sedimentation and surface fine sediment and other environmental variables; e) investigate potential differences in trends in surface fines and overwinter sedimentation in different rivers and reaches. Prior to the onset of spawning, surface fine sediment will be measured by the grid method (Bauer and Burton, 1993); overwinter sedimentation will be measured by burying containers filled with cleaned gravels at depths typical of egg centrum in areas excavated to mimic salmon redds. After fry emergence, containers will be collected and samples analyzed for the magnitude of fine sediment.

Section 8. Project description

a. Technical and/or scientific background

Previous watershed assessments have consistently noted that fine sediment is a major problem in the Grande Ronde River (GRR) (Anderson et al., 1992; Huntington, 1993; NMFS, 1993; Mobrand et al., 1995) and, to a lesser extent, in the John Day River (JDR) (OWRD, 1986). High levels of fine sediment can reduce salmon survival from egg-to-smolt by contributing to egg entombment and reductions in pool volumes, egg pocket dissolved oxygen, interstitial rearing space, and food (USFS, 1983; Everest et al., 1987; Chapman, 1988; Bjornn and Reiser, 1991; Scully and Petrosky, 1991; Lisle and Hilton, 1992). In the GRR, reductions in sediment delivery and fine sediment have been repeatedly identified as a priority measure to improve habitat conditions and salmon survival (Anderson et al., 1992; NMFS, 1992; Huntington, 1993; Mobrand et al., 1995).

Our proposed project will monitor surface fine sediments and overwinter intrusion of fine sediments into cleaned gravels in spawning habitat for five years to determine baseline conditions and trends and whether habitat objectives for substrate in salmon habitat are being met in monitored reaches. NMFS (1995) and CRITFC (1995) set goals for surface fine sediment in spawning habitat at <20%. The NPPC's 1994 Fish and Wildlife program set a goal of <20% fine sediments in salmon redds in measure 7.6D (NPPC, 1994). Watershed assessments have recommended monitoring and investigation of relationships between surface substrate conditions and fine sediment conditions in redds in the Grande Ronde (Anderson et al., 1992; NMFS, 1993). Despite these goals for fine sediment and documented sediment-related problems, baseline and trends in surface fine sediment are not being monitored in these rivers, to our knowledge.

It has been posited that high levels of fine sediment in ambient stream substrate may not reduce egg-to-fry survival because salmon winnow fine sediment from the redd during spawning (Everest et al. 1987; Chapman 1988). However, it has been documented in laboratory and field settings that sedimentation of fine sediment occurs in salmonid redds subsequent to spawning (Meehan and Swanston, 1977; Beschta and Jackson, 1979; Chapman, 1988; Lisle, 1989; Grost et al., 1991). Our proposed project will investigate sedimentation within redds during the incubation period by measuring overwinter intrusion of fine sediment into cleaned gravels in a field setting resembling redds.

The project will also investigate the potential relationship between surface fines sediment levels and overwinter intrusion rates. The amount and size distribution of fine sediment at the surface of channel substrate can affect sediment transport during the incubation period (Carson and Griffiths, 1987; Wilcock and McArdell, 1997) and thereby affect sedimentation and resultant fine sediment concentration in redds (Lisle, 1989). Within a stream reach, the threshold of stream discharge needed to initiate sediment transport decreases with decreasing particle size at the substrate surface (Carson and Griffiths, 1987; Wilcock and McArdell, 1997). Fine sediment at the substrate surface can be transported at low levels of stream discharge (Booth and Jackson, 1997). The expected frequency of flow exceedance increases with decreasing stream discharge (Leopold, 1992). Therefore, it is likely that streams with high levels of fine sediment at the substrate surface have a greater frequency and duration of sediment transport than streams with lower levels of surface fine sediment, assuming other factors remain equal (Leopold, 1992; Wilcock and McArdell, 1997). The infiltration of fine sediment into a relatively clean substrate in redds appears inexorable once transport of fine sediment begins (Chapman, 1988; Lisle, 1989). The amount of fine sediment deposited into cleaned gravels is mediated by a variety of factors, but it generally increases as the particle sizes in transport decrease, because smaller particles settle deeper within the substrate (Beschta and Jackson, 1979). Thus, it is likely that the amount of fine sediment at the surface of channel substrate may affect salmon survival by influencing the amount of fine sediment in salmon redds during the incubation period.

Despite the biological and management importance of the relationship among ambient substrate conditions, fine sediment levels in redds, and the survival of threatened salmon, to our knowledge there have been no investigations of these relationships in northeastern Oregon, USA and very few elsewhere.

Reckendorf and Van Liew (1989) monitored fine sediment intrusion into artificial redds for two years in the Tucannon River, Washington. Intrusion was measured by sequential freeze core samples taken during the incubation period for spring chinook salmon. They found increases in fine sediment in the artificial redds in all areas sampled. The study did not rigorously analyze the potential relationship between intrusion into artificial redds and surface fine sediments. Reckendorf and Van Liew (1989) concluded that the pebble count method (Wolman, 1954) which was used to characterize the substrate surface, did not account for the sizes of fine sediment at the substrate surface that intruded into the artificial redds. In contrast, the proposed project will measure surface fine sediments as recommended in situations where fine sediment covers a significant amount of the substrate surface and differential transport and intrusion of sediment are of interest (Smith et al., 1997). Unlike the proposed project, the study of Reckendorf and Van Liew was not aimed at investigating: temporal trends in overwinter sedimentation or surface substrate conditions; the relationship of substrate conditions to the objectives of Columbia Basin habitat restoration approaches (e.g., CRITFC, 1995); the relationship of surface fine sediment to intrusion; or inter-stream differences in substrate conditions and temporal trends.

Fine sediment intrusion has been investigated in Idaho in spawning habitat for chinook salmon (King and Thurow, 1991) and steelhead and cutthroat trout (King et al., 1992), using sequential freeze cores in artificial redds and intrusion buckets in cleaned gravels. Generally, fine sediments increased during the incubation period, although during the incubation period for steelhead, spawning gravels that were initially high in fine sediment showed a decrease in fine sediment (King et al., 1992). In the South Fork Salmon River, Idaho, during the incubation period for spring chinook salmon, intrusion buckets with cleaned gravels rapidly accumulated fine sediments, even during low flow periods (King and Thurow, 1992). Intrusion buckets with cleaned gravels accumulated fine sediment more rapidly than substrate with a mixture of sediment sizes in artificial redds (King et al., 1992). These studies differed from the proposed project in that they did not investigate multi-annual trends or the potential relationship between surface substrate conditions and overwinter sedimentation of fine sediments.

The project proposes to focus on surface fine sediment and fine sediment intrusion for several reasons. First, surface fine sediment can be measured more rapidly and at less expense than substrate composition at depth. If there is a relationship between surface fine sediment and fine sediment intrusion, monitoring of surface fine sediment may provide an more efficient means of monitoring substrate trends affecting salmon survival. Second, surface fine sediment has been set as an objective in regional approaches to protect and restore salmon habitat (e.g., CRITFC, 1995). Third, the amount and size distribution of fine sediment at the surface of channel substrate can affect sediment transport during the incubation period and thereby affect sedimentation and resultant fine sediment concentration in redds, as previously discussed. Fourth, direct measurement of surface fines has been recommended where fine sediment covers a significant amount of the substrate and/or differential transport of sediment and fine sediment intrusion are of interest (Kondolf, 1997; Smith et al. 1997). Substrate composition at depth may have little effect on overwinter intrusion, because flows that fully mobilize the channel bed are relatively rare during the incubation period. While larger substrate particles are not moved below some threshold of discharge, sands and finer sediment can be transported by very small flows. The total bed composition may not be directly related to conditions within redds because salmon winnow fine sediment during spawning (Chapman, 1988).

Adaptive management implications include the following. The proposed project will provide an updated assessment of substrate conditions and trends in salmon spawning habitat. Thus, it can indicate whether watershed level restoration efforts, when combined with cumulative effects under a variable climatic and hydrologic regime, have been adequate to allow key habitat conditions to improve. This information can be used to determine whether additional restoration efforts may be needed to improve habitat conditions. The study will also supply information to determine whether substrate trends and conditions in monitored reaches meet the objectives of NPPC (1994), CRITFC (1995) and NMFS (1995). This addresses one of the primary, unresolved issues related to land management effects on salmon habitat: whether improvements in land management, including restoration activities, in combination with existing watershed conditions (e.g., road networks) are effective enough, in aggregate, to allow improvement in habitat conditions. Although restoration activities and erosion reduction measures have been taken in some of the watersheds within the project study, these watersheds also have many sources of accelerated sediment delivery, such as roads and mining. Natural disturbances, such as fires, can also contribute elevated sediment delivery. It is uncertain that improved land management and restoration efforts at the watershed scale, together with existing watershed conditions, will be adequate to improve sediment conditions in spawning habitat.

The bottom-line goal of Columbia Basin watershed efforts related to salmonids is improvement in habitat conditions and salmonid survival. Substrate condition and trend data provide an indication of the need to make additional efforts to prevent and reduce elevated sediment delivery in areas where fine sediment is a major habitat problem (PNF, 1988; Platts et al., 1989; Anderson et al., 1992; Espinosa et al., 1997), as is the case in the GRR (Anderson et al., 1992; Huntington, 1993; NMFS, 1993; Mobrand et al., 1995).

While one of the goals of the project is to assess the cumulative effectiveness of land management in reducing fine sediment, the project is <u>not</u> aimed at attempting to identify which particular activities are effective or ineffective. The proposal's goals are to test the hypothesis that salmon habitat and survival has improved and will continue to do so, consistent with the goals of recovery plans (CRITFC, 1995). Other objectives include determining if fine sediment goals of NPPC (1994), NMFS (1995), and CRITFC (1995) are being met; determining if additional restoration/protection measures are needed (e.g., if high levels of fine sediment are maintained or are increasing); and, investigating the relationship between surface fines and fine sediment intrusion. and estimation of egg-fry survival. These goals do not require a full sediment budget. Reid and Dunne (1997) noted that complete sediment budgets (including erosion and sedimentation) are <u>not</u> necessary to evaluate every land management issue. The simplest possible approach should be employed to answer a specific management question related to sediment (Reid and Dunne, 1997). The project takes the simplest possible approach to meeting project objectives.

The collection of data for five years under the project will allow statistical analysis of the the magnitude, direction, and statistical significance of potential trends in surface fines and overwinter sedimentation, even in the absence of pre-existing data. In its 1997 review of the project, the Watershed Technical Work Group noted the importance of "'pre' information" to ascertaining trends in habitat quality. This underscores the importance of collecting baseline information, as will be done under the project, so data are available for future investigations of trends in habitat attributes.

b. Rationale and significance to Regional Programs

The project will monitor trends in surface fine sediments and overwinter sedimentation and examine potential relationships between them as specifically recommended for the GRR in watershed assessments (Anderson et al., 1992; NMFS, 1993). The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) have endorsed implementation of Anderson et al. (1992) as a keystone of the CTUIR's policy on salmon habitat (CTUIR, 1995).

The project will measure baseline substrate conditions and trends as recommended in NMFS (p. 68, 1995) and (CRITFC, 1995). NMFS (1995) noted that measurement of important habitat components, such as substrate, is a critical aspect of the recommended effectiveness monitoring (NMFS, p. 86, 1995).

By measuring substrate conditions, the project will determine if current substrate goals set in watershed-scale and regional plans are being met in monitored reaches. (CRITFC, 1995) and NMFS (1995) set a substrate standard of <20% surface fine sediment in spawning habitats. The NPPC's Fish and Wildlife program sets a goal of <20% fine sediments in salmon redds in measure 7.6D (NPPC, 1994). The proposed project will monitor overwinter intrusion in cleaned gravels in areas excavated to mimic salmon redds to estimate whether the NPPC's substrate goal is being met in monitored reaches. The project will also supply trend data to determine progress towards NPPC substrate objectives as recommended in NPPC Fish and Wildlife Program measures 3.3D.1 and 7.6C.2. Collection of trend data on key habitat variables, such as substrate, have repeatedly been recommended in regional efforts to restore salmon habitat (CRITFC, 1995; NMFS, 1995) and cited as lacking in the GRR (NMFS, 1993).

The project will also provide data on habitat conditions, using peer-reviewed methods (e.g., Lisle and Eads, 1991), as recommended in NPPC Fish and Wildlife measure 7.6C. The trend data should indicate of whether watershed efforts have been adequate to lead to improved substrate conditions within monitored reaches, which should be useful to watershed councils, the Grande Ronde Model Watershed, and other entities interested in improving salmon habitat.

c. Relationships to other projects

The project will provide updated data on the trend and condition of fine sediments in monitored reaches in spawning habitats in the GRR and JDR. This will indicate whether substrate objectives are met and/or improving, which can be used to assess the aggregate effectiveness of past and on-going restoration efforts together with the effects of watershed conditions. This information can also be used to assess the need for additional sediment abatement actions. The information should be useful to all land and fish management entities in the two watersheds, including the Grande Ronde Model Watershed Project (BPA Project #: 9402700 and 908300).

d. Project history (for ongoing projects)

The previous project number was 5506000. Due to administrative delays at BPA, project funding did not begin until Jan. 1, 1998. The project was funded at $30,000 from Jan. 1, 1998 through Dec. 1998 with FY97 funds and from Aug. 1, 1998 through July 31, 1999 with FY98 funds. Due to the administrative delays, the <u>funded</u> project has not generated reportsor major results, because the delays precluded emplacement of containers of cleaned gravels prior to spawning in the 1997 season (Aug.-Sept.). Sampling and container emplacement for measurement of overwinter sedimentation could not occur until Aug. 1998. Measurements of overwinter sedimentation will not be available until 1999, after the collected samples are analyzed. In September 1998, surface fine sediment levels were monitored in reaches with spawning habitat in the North Fork John Day River (NFJDR), Granite Creek (tributary to the NFJDR), the Upper GRR, and Catherine Creek (tributary to the GRR) and containers of cleaned gravels were also emplaced. Locations of surface fine monitoring and containers of clean gravels were benchmarked a global positioning system. Analysis of surface fine sediment data is ongoing. Two containers, each, were collected mid-winter in the Upper GRR and Catherine Creek. The containers' contents are undergoing particle size analysis. The remainder of the containers will be collected after fry emergence in the spring of 1999.

ESA consultation with NMFS was completed with NMFS concurring with the biological assessment that the project was unlikely to adversely affect fish species listed under the ESA. The USFWS concluded that project consultation was not required for effects related to bull trout.

The results of previous, but unfunded efforts, similar to the proposed project, were presented at the conference on Land Management Affecting Aquatic Ecosystems, in Calgary, Alberta in May, 1996. In 1998, the editors confirmed that the paper describing the results (Rhodes and Purser, *in press*) was accepted for publication in the peer-reviewed proceedings. Results in Rhodes and Purser (*in press*) include: 1) overwinter sedimentation occurred in cleaned gravels in all reaches in all years monitored; 2) among reaches and years, the magnitude of overwinter sedimentation and % surface fines had a statistically significant relationship; 3) reaches with the highest levels of surface fine sediment consistently had the highest levels of overwinter sedimentation; 4) stream discharge was not related to overwinter sedimentation in a statistically significant fashion; 5) ocular estimates of surface fines had standard error of about 5% and no significant bias, when compared to measured surface fines.

e. Proposal objectives

Obj 1.: For five years, annually measure surface fine levels in monitored reaches and determine if substrate goals of CRITFC (1995) and NMFS (1995) are met.

Obj. 2.: For five years, annually measure overwinter of sedimentation of fine sediment and estimate if substrate goals of NPPC FW Program (NPPC, 1994) are met.

Obj. 3.: Estimate effects of fine sediment on salmon survival from egg-to-emergence, using available data and methods.

Obj. 4.: Investigate potential temporal trends in surface fine sediment and overwinter sedimentation based on results of multi-year sampling and analysis.

Obj. 5.: Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels.

Obj. 6.: Determine if spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation.

Obj. 7: Report results and disseminate to watershed councils and fish and land management entities.

Our proposed project will also test the following hypotheses: 1) The fine sediment substrate goals in recovery plans (NPPC, 1994; CRITFC, 1995) and biological opinions (NMFS, 1995) are being met; 2) the aggregate effectiveness of land management is adequate to meet substrate goals, prevent substrate degradation, and improve substrate conditions; 3) overwinter sedimentation in salmon redds is not occurring at levels that reduce salmon survival; 4) levels of overwinter sedimentation surface fine sediment are not related; 5) different streams do not have significantly different levels of surface fine sediment or overwinter sedimentation in spawning habitat; 6) temporal trends in surface fine sediment levels and the magnitude of overwinter sedimentation are not significantly different in different streams.

The proposed project will generate reports that are based on recommended monitoring and provide information cited as necessary in the NPPC Fish and Wildlife Measures 7.6C, 7.6C.2, and 7.6D, NMFS (1993; 1995), and CRITFC (1995). It will also provide information on whether substrate goals are met (e.g., CRITFC, 1995) and if habitat conditions are maintained or improving. All summary data and analysis will be supplied to StreamNet.

f. Methods

Obj 1., Task a: For five years, annually measure surface fine sediments in monitored reaches in JDR and GRR.

Obj. 2., Task a: Prior to onset of spawning, annually place containers of cleaned gravel at depths similar to salmon egg centrums, in areas excavated to mimic salmon redds in spawning habitat. Collect containers after emergence and measure overwinter sedimentation of fine sediments (% by volume with diam<6.4mm and <0.8 mm) via standard soil particle size methods.

Obj. 3., Task a: Estimate effects of fine sediment on salmon survival from egg-to-emergence by analyzing results of tasks in Objectives 1 and 2, using available methods relating fine sediment to salmon survival.

Obj. 4., Task a: Analyze results of multi-year sampling and analysis of surface fine sediment and overwinter sedimentation via regression analysis and analysis of variance to determine statistical significance of temporal trends in monitored reaches.

Obj. 5, Task a: Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels, using non-parametric analyses of variance.

Obj. 6, Task a: Determine if monitored spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation, using non-parametric analyses of variance.

Obj. 7, Task a: Report and disseminate findings via annual and final reports, presentations to watershed councils and land and fish management entities, reporting of results to StreamNet, and submission of an article summarizing results to a peer-reviewed publication.

Study reaches have been established within spawning habitat in sections of the JDR and GRR. These reaches include sites within relatively unimpacted sections of the JDR and heavily impacted sections of the GRR and JDR.

Surface fine sediment will be annually measured at the onset of the spawning period using the grid method (Bauer and Burton, 1993). Although the pebble count method is not well-suited for characterizing substrate when the particle size distribution is bimodal (Smith et al., 1997) or fine sediment covers a significant amount of the substrate (Wolman, 1954; Nelson et al., 1996), starting in 1999, both the pebble count method and the grid method will be used. The results will be analyzed and compared.

Containers filled with cleaned gravels will be emplaced annually in artificially constructed salmon redds prior to the onset of the salmon spawning. This method has been used successfully to monitor fine sediment accumulation in channel substrate in northern California (Lisle, 1989), and provides an indication of the ultimate sediment conditions in redds (Lisle and Eads, 1991). Although there is uncertainty regarding the exact composition of natural salmon redds and how this influences egg pocket conditions (Chapman, 1988), the use of the proposed approach provides at least some in-channel approximation of fine sediment conditions within redds (Lisle and Eads, 1991) and perhaps the only one available, since destructive sampling of actual redds is unlikely to be allowed with the existing listing of salmon under the ESA.

The artificially consturcted redds will be excavated in pool tailouts in salmon spawning habitats according to the dimensions and shape of natural redds described in Bjornn and Reiser (1991). The bottom of the containers will be located within the range of depths that egg centrums are found within redds, as described in Bjornn and Reiser (1991). Sample placement will occur prior to spawning to avoid effects on spawning. Two containers of cleaned gravels will be placed within each constructed redd; at least five redds will be constructed within one monitored reach in each river. At least two containers will be collected mid-winter in the most accessible reaches to provide some estimate of the rate of overwinter sedimentation during the incubation period. The majority of the containers will be collected shortly after the end of the incubation period. The amount and particle size of accumulated sediment within the containers of cleaned gravels will be determined using standard particle size methods.

Salmon survival from egg-to-fry will be estimated from the fine sediment and overwinter sedimentation data via the methods of Stowell et al. (1983) and the data of Scully and Petrosky (1991). Although there are uncertainties regarding the accuracy of these methods (Chapman, 1988), they provide some estimate of differential survival in areas with differing levels of fine sediment.

The relationship between surface fine sediment and overwinter sedimentation will be analyzed via regression analysis. This potential relationship will be investigated for two reasons: 1) the data will be available without additional effort; and 2) to investigate whether monitoring surface fines can be a useful surrogate for bulk monitoring of bed composition. The latter consideration is key, because sampling of bed materials at depth is time-consuming and expensive, yet still introduces bias in some environments (Platts et al., 1987; Lisle and Eads, 1991). In warm water (about 70°F), more than 45 minutes may be required to obtain a single freeze core (R. Baker, USFWS, pers. comm., Sept. 8, 1997). Many cores are needed to provide an indication of conditions within a reach (Lisle and Eads, 1991). In contrast, surface fines within a reach can be measured using the grid method in less than 75 minutes using five randomly spaced measurement points across three transects within a reach. Visual estimation of surface fines can be done still more rapidly and with reasonable accuracy: preliminary data indicate that with trained observers, when compared to surface fines measured by the method of Bauer and Burton (1993), ocular estimates of surface fines have a standard error of about 5% and no significant bias (Rhodes and Purser, *in press*). Further, determination of sedimentation in redds during the incubation period by bulk sampling, requires repeated sampling (Lisle and Eads, 1991). There is limited assurance that such "before" and "after" comparisons are valid given the destructive nature of sampling and questions regarding bias and accuracy (Lisle and Eads, 1991). Therefore, if there is a valid relationship between surface fines and intrusion levels in some streams, measuring surface fines, alone, may be adequate to assess relative trends in habitat condition and salmon survival at a fraction of the expense and effort related to bulk substrate sampling.

Discharge in the study reaches during the monitoring period will be estimated from data from the gaging stations nearest the study reaches, using area/elevation methods (Dunne and Leopold, 1978). Stream width, gradient, and depth will be measured using standard methods (Dunne and Leopold, 1978). The relationship between stream discharge and overwinter sedimentation will be analyzed by regression analysis to assess whether potential sediment transport capacity appears to affect the magnitude of overwinter sedimentation. However, preliminary data indicate that stream discharge attributes explain little of the variability in the volume of overwinter sedimentation in cleaned gravels (Rhodes and Purser, *in press*).

Variability within and among sample sites will also be analyzed using standard statistical methods. Initial estimates of variability will be used to estimate the number of samples needed in future investigations to generate a given level of statistical significance at given probabilities of "type I and II" errors using standard statistical methods (Benjamin and Cornell, 1970). Based on the analysis, the number of samples will be adjusted in future years. Trends will be analyzed via standard regression methods.

The project "looks only at the channel" because the project focuses on measuring substrate conditions over time in monitored reaches and investigating the relationship of substrate conditions to management objectives and the potential relationship between surface fine sediment and overwinter intrusion of fine sediment in spawning habitat. There are many sources of fine sediments in the watersheds of the GRR and JDR. Linking in-channel changes to specific activities and sources of sediment would require a greatly expanded effort and budget. While such an expanded approach has merit, it is not the focus of the proposed project. The proposed project would certainly complement efforts to link causes of the problem to in-channel conditions.

g. Facilities and equipment

No major special equipment is needed. Vehicles will be rented. The CRITFC has suitable office space and personal computers that support a variety of widely used word-processing, spreadsheet, and statistical analysis applications adequate to store and analyze data and report findings.

h. Budget

The budget has been increased relative to previous years to reflect an increases in increase in project leader salaries, per diem, and vehicle rental costs and associated increases in fringe and indirect costs caused by these increases. In total, the request budget for FY20000 funds is about 7% greater than the FY97 budget, a reasonable increase over a 3 year period.

Section 9. Key personnel

Michael D. Purser, Principal Habitat Specialist (Snohomish County, WA) and Consulting Hydrologist. Project FTE: 0.03. Project Duties: Sample and data analysis, report writing. Education: B.S. Natural Resource Planning and Interpretation (Humboldt State Univ., 1983); M.S. Forest Resources--Hydrology (Univ. of Wash., 1988). Certification status: None. Current Employer: Snohomish County (WA) Dept. of Public Works (7/98-present). Current Responsibilities: Development of stream and habitat restoration/protection measures to protect and restore listed anadromous fish in Snohomish County. Recent Previous Employment: Forest Hydrologist/Watershed Management Specialist, CTUIR (4/91-6/97); Research Technologist, Wash. State Univ. (10/87-4/91); Water Quality Consultant, Jefferson County Conservation District, (7/86-10/87) Expertise: Watershed hydrology, salmonid habitats, water quality, soils, sediment transport, monitoring of non-point source pollution, and geomorphology. Recent/relevant publications/job completions: 1) Co-author with eight others: 1992. The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan; 2) Purser, M.D. and Cundy, T.W., 1992. Changes in soil physical properties due to cable yarding and their hydrologic implications. Western J. Applied Forestry. 7: 36-39.; 3) Preparation and governmental coordination of the implementation of Nonpoint Source of Water Pollution Assessment and Management Program, Umatilla River Basin, under contract with USEPA; 4) Rhodes, J.J. and Purser, M.D., *in press*. Overwinter sedimentation of clean gravels in simulated redds in the upper Grande Ronde River and nearby streams in northeastern Oregon, USA: Implications for the survival of threatened spring chinook salmon, Proceedings of Forest-Fish Conference: Land Management Affecting Aquatic Ecosystems, Calgary, Alberta, Canada, May, 1996.

Jon Rhodes, Hydrologist, Columbia River Inter-Tribal Fish Commission (CRITFC), Project FTE: 0.25. Project Duties: Monitoring, data analysis, project oversight and coordination, report writing. Education: B.S. Hydrology and Water Resources (Univ. of Arizona, 1981); M.S. Hydrogeology (Univ. of Nev.-Reno, 1985); Ph.d. candidacy degree Forest Hydrology (Univ. of Wash., 1989). Certification status: None. Current Employer: CRITFC (4/89-present). Current Responsibilities: Analysis of direct and cumulative effects of land-use on salmon habitat, channel morphology, water quality, and watershed processes. Provide scientific input as a member of numerous policy and technical forums dealing with aquatic issues, including forest practices and water quality monitoring programs. Recent Previous Employment: Research Assistant, Univ. of Wash. (11/88-4/89, 8/84-6/87); Consulting Hydrologist, Tahoe Regional Planning Assoc. (5-10/88, 7-10/87); Hydrologic Tech., USGS (10/83-6/84). Expertise: General watershed hydrology, water quality, direct and cumulative effects of land-use on aquatic resources, monitoring non-point source pollution, water temperature alteration, sedimentation, analysis of water quality data. Recent/relevant publications/job completions: 1) Co-author with eight others: 1992. The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan; 2) A Coarse Screening Process for Evaluation of the Effects of Land Management Activities on Salmon Spawning and Rearing Habitat in ESA Consultations. CRITFC Tech. Rept. 94-4, Portland, Or.--developed under contract with NMFS; 3) 1995. A Comparison and Evaluation of Existing Land Management Plans Affect Spawning and Rearing Habitat of Snake River Basin Salmon Species Listed Under the Endangered Species Act, CRITFC, Portland, Or, unpub. (1995)--developed under contract with NMFS; 4) Espinosa, F.A., Rhodes, J.J., and McCullough, D. A. 1997. The failure of existing plans to protect salmon habitat on the Clearwater National Forest in Idaho. J. Env. Management **49**: 205-230; 5) Rhodes, J.J. and Purser, M.D., *in press*. Overwinter sedimentation of clean gravels in simulated redds in the upper Grande Ronde River and nearby streams in northeastern Oregon, USA: Implications for the survival of threatened spring chinook salmon, Proceedings of Forest-Fish Conference: Land Management Affecting Aquatic Ecosystems, Calgary, Alberta, Canada, May, 1996.

Section 10. Information/technology transfer

As mentioned, the project will provide an indication of the overall, cumulative effectiveness of efforts to prevent deterioration in substrate conditions and, ultimately improve substrate conditions. This information can be used to assess the cumulative effectiveness of aggregate restoration measures within the context of total watershed conditions that affect channel substrate. Such information can be used to determine the need for different or additional efforts to control and abate sediment delivery (in the case of a deteriorating trend) or to continue on-going efforts (in the case of an improving trend) emphasizing past efforts that have been shown to be effective.

Study results will be reported in annual and final reports, submitted for publication in a peer-reviewed journal, presented to watershed councils and fish and land management entities, presented at symposia, and supplied to StreamNet

Congratulations!